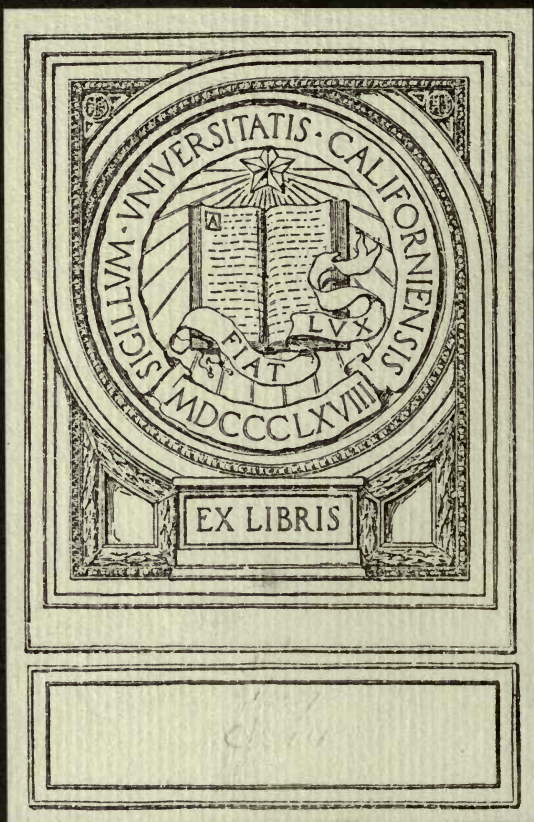


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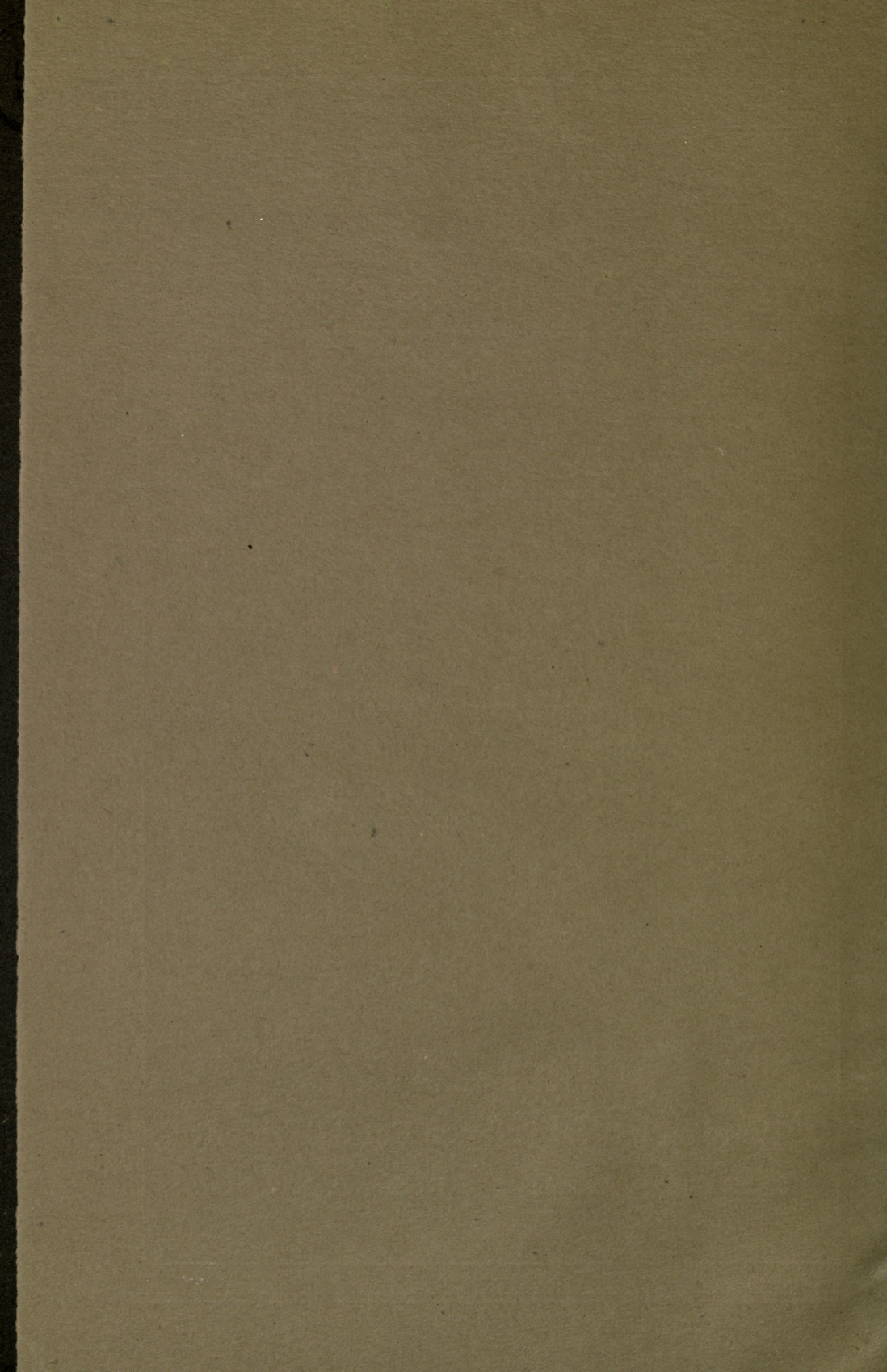
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DESCRIPTIVE CATALOGUE
OF A
Petrographic Collection
OF
American Rocks

BY
R. W. CLARK
Instructor of Petrography
Mineralogical Laboratory
University of Michigan

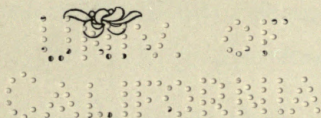


PUBLISHED BY
Ward's Natural Science Establishment
84-102 College Avenue Rochester, New York



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Preface

THIS collection of American rocks is arranged and described for the purpose of providing secondary schools, colleges and universities with a series of typical rocks that occur in the United States, although in a few instances rocks from foreign localities have been included. The descriptions in the catalogue are intended to aid those less experienced in the use of the petrographic microscope in the determination of the constituents of the rock and to serve as a guide to the more advanced students. They are not considered detailed or complete, as such descriptions would be unnecessary for either of the above purposes.

Wherever possible references to the literature are given for the benefit of those interested in learning more about the occurrence of the rocks. While some of these references give more detailed petrographic descriptions than are included here, they are selected, chiefly, because they show the geological relations of the rock in question.

The arrangement and classification of the rocks is based on Kemp's Handbook of Rocks.

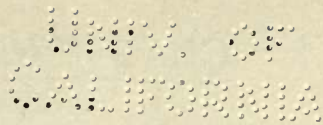
R. W. CLARK,

Instructor of Petrography.

*Mineralogical Laboratory
University of Michigan.*

416831

SEPTEMBER 1ST, 1916.



Introduction

IN the following pages Mr. Clark has made a contribution of great value to teachers of Petrography. Many a teacher who has only a limited time allotted for the science has been puzzled to select a properly balanced series of rocks for study. Even when such a series has been chosen, he has met a new difficulty in finding concise descriptions and in many instances the particular specimens available for illustration are found to vary widely from the published descriptions of the rocks most nearly like his specimens. To overcome these difficulties Mr. Clark has enlisted the cooperation of Ward's Natural Science Establishment and the exact rocks described herein as well as microscope slides of thin sections from them can be secured from this establishment.

Mr. Clark has wisely chosen to base his classification on a standard text book, Kemp's "Handbook of Rocks" being used. It is believed that this will be a distinct advantage in the study of this series of rocks as it will enable the teacher to utilize Kemp's admirable work, especially in correlating these and other rocks.

GEORGE LETCHWORTH ENGLISH.

CLASSIFICATION

Arrangement based on Kemp's "Handbook of Rocks"

A. Igneous Rocks

I. Glasses:

- | | |
|------------------|------------------------|
| 1. Scoria—Utah | 4. Perlite—Colorado |
| 2. Pumice—Utah | 5. Vitrophyre—Colorado |
| 3. Obsidian—Utah | |

II. Rhyolite-Granite Series:

- | | |
|---|-------------------------------|
| 6. Rhyolite—Colorado | 13. Porphyritic Granite—Mass. |
| 7. Felsite (Aporhyolite)—Mass. | 14. Binary Granite—N. H. |
| 8. Quartz-Felsite Porphyry—Mass. | 15. Binary Granite—Colorado |
| 9. Quartz-Felsite Porphyry—Virginia | 16. Biotite-Granite—R. I. |
| 10. Rhyolite Porphyry—South Dakota | 17. Biotite-Granite—Vermont |
| 11. Rhyolite Porphyry (Nevadite)—
Oklahoma | 18. Alkali Granite—Mass. |
| 12. Pumiceous Rhyolite—Colorado | 19. Hornblende-Granite—Mass. |
| | 20. Pegmatite—New York. |

III. Trachyte-Syenite Series:

- | | |
|---------------------------------|--------------------------------|
| 21. Sanidine-Trachyte—Colorado | 24. Quartz-Syenite—New York |
| 22. Trachyte Porphyry—S. Dakota | 25. Hornblende-Syenite—Vermont |
| 23. Bostonite—New York | 26. Monzonite—Colorado |

IV. Phonolite-Nephelite-Syenite Series:

- | | |
|------------------------------|--|
| 27. Phonolite—Colorado | 30. Nephelite-Cancrinite-Syenite—
Maine |
| 28. Leucite-Syenite—Arkansas | |
| 29. Nephelite-Syenite—Mass. | 31. Essexite—Massachusetts |

V. Dacite-Quartz-Diorite Series:

- | |
|-------------------------------------|
| 32. Mica Dacite—Colorado |
| 33. Granodiorite—Minnesota |
| 34. Quartz-Monzonite Porphyry—Colo. |

VI. Andesite-Diorite Series:

- | | |
|----------------------------------|-------------------------------|
| 35. Hornblende-Andesite—Colorado | 38. Andesite Breccia—Colorado |
| 36. Andesite Porphyry—Mass. | 39. Hornblende-Diorite—Mass. |
| 37. Andesite Porphyry—Colorado | |

VII. Basalt-Gabbro Series:

- | | |
|--------------------------------------|--|
| 40. Hornblende-Basalt—Colorado | 47. Diabase—Massachusetts |
| 41. Olivine-Basalt Porphyry—Colorado | 48. Olivine-Augite-Hypersthene Gabbro
—Oklahoma |
| 42. Dolerite Porphyry—Mass. | 49. Hornblende-Gabbro—Mass. |
| 43. Vesicular Basalt—Colorado | 50. Hypersthene-Gabbro (Norite)—
New York |
| 44. Amygdaloidal Diabase—Michigan | |
| 45. Quartz-Diabase—New York | 51. Anorthosite—New York |
| 46. Diabase—New Jersey | |

VIII. Pyroxenite-Peridotite Series:

- | | |
|--------------------------------------|-----------------------------|
| 52. Pyroxenite (Bronzite)—N. C. | 55. Cortlandtite—New York |
| 53. Peridotite (Lherzolite)—Maryland | 56. Kimberlite—South Africa |
| 54. Dunite—North Carolina | |

B. Sedimentary Rocks

I. Breccias and Conglomerates:

- | | |
|-----------------------------------|----------------------------------|
| 57. Limestone Breccia—Colorado | 59. Quartz-Conglomerate—Pa. |
| 58. Jasper-Conglomerate—S. Dakota | 60. Copper Conglomerate—Michigan |

II. Sandstones:

- | | |
|--------------------------------|----------------------------|
| 61. Red Sandstone—New York | 64. Brownstone—Connecticut |
| 62. Berea Grit—Ohio | 65. Arkose—North Carolina |
| 63. Banded Sandstone—S. Dakota | 66. Novaculite—Arkansas |

III. Argillaceous Sandstones, Shales and Calcareous Sandstones:

- | | |
|--|--------------------------------|
| 67. Argillaceous Sandstone—Nevada | 71. Calcareous Shale—New York |
| 68. Flagstone—New York | 72. Green Shale—New York |
| 69. Arenaceous Shale—New York | 73. Carbonaceous Shale—Pa. |
| 70. Calcareous-bituminous Shale—
California | 74. Green Sandstone—New Jersey |

IV. Limestones and Dolomites:

- | | |
|-------------------------------------|------------------------------------|
| 75. Coral Limestone—Indiana | 82. Oolitic Limestone—Indiana |
| 76. Encrinal Limestone—New York | 83. Oolitic Limestone—Pennsylvania |
| 77. Pearly Shell Limestone—New York | 84. Siliceous Dolomite—New York |
| 78. Argillaceous Limestone—New York | 85. Dolomitic Limestone—Minnesota |
| 79. Lithographic Limestone—Bavaria | 86. Birdseye Limestone—New York |
| 80. Cherty Limestone—New York | 87. Black Limestone—Vermont |
| 81. Hydraulic Limestone—New York | 88. Chocolate Marble—Tennessee |

V. Siliceous Rocks:

- | | |
|-----------------------------------|-----------------------------------|
| 89. Diatomaceous Earth—California | 92. Geyselite—Wyoming |
| 90. Flint—Pennsylvania | 93. Siliceous Oolite—Pennsylvania |
| 91. Chert—Missouri | |

VI. Chemical Precipitates:

- | | |
|-----------------------------|-------------------------------|
| 94. Travertine—California | 96. Gypsum—Michigan |
| 95. Anhydrite—New Brunswick | 97. Oolitic Iron Ore—New York |

C. Metamorphic Rocks

I. Gneisses and Crystalline Schists:

- | | |
|--|--|
| 98. Biotite-Gneiss—Massachusetts | 104. Graphite Mica-Schist—N. Carolina |
| 99. Hornblende-Gneiss—New York | 105. Tourmaline Mica-Schist—
South Dakota |
| 100. Sillimanite-Garnet-Gneiss—
New York | 106. Hornblende-Schist—New York |
| 101. Porphyritic Gneiss—Connecticut | 107. Chlorite-Schist—Vermont |
| 102. Muscovite-Schist—New York | 108. Talc-Schist—New Jersey |
| 103. Garnetiferous Mica-Schist—
Connecticut | |

II. Quartzites and Slates:

- | | |
|--|---------------------------------|
| 109. Baraboo Quartzite—Wisconsin | 112. Red Roofing Slate—New York |
| 110. Barron Quartzite—Wisconsin | 113. Gray Roofing Slate—Pa. |
| 111. Quartz-Sericite-Schist—
Pennsylvania | 114. Green Slate—Vermont |
| | 115. Hydromica-Schist—Virginia |

III. Crystalline Limestones and Dolomites:

- | | |
|------------------------------------|---|
| 116. White Marble—Vermont | 119. Dolomite-Marble—New York |
| 117. Dolomite-Marble—Massachusetts | 120. Gray Marble—New York |
| 118. Pink Marble—Georgia | 121. Variegated Dolomite-Marble—
Vermont |

IV. Opicalcite, Serpentine and Soapstone:

- | | |
|----------------------------|----------------------------|
| 122. Opicalcite—New York | 124. Verde Antique—Vermont |
| 123. Serpentine—New Jersey | 125. Soapstone—Virginia |

A. Igneous Rocks

I. Glasses:

No. 1. Scoria—Near Black Rock, Millard County, Utah.

Ref. O. E. Meinzer. U. S. Geological Survey Water Supply Paper 277.

MACROSCOPIC: Reddish-brown cellular rock with glassy phenocrysts.

MICROSCOPIC: Porphyritic texture. The phenocrysts are fresh, sharp lath-shaped labradorite showing albite twinning. The groundmass is opaque and contains abundant blowholes, some of which are filled with a fine brown aggregate of polarizing material.

No. 2. Pumice—Near Black Rock, Millard County, Utah.

Ref. O. E. Meinzer. U. S. Geological Survey Water Supply Paper 277.

MACROSCOPIC: The rock is a white fine frothy glass.

MICROSCOPIC: The slide is composed mostly of colorless glass with blowholes elongated in one direction. The glass is sometimes turbid and this between crossed nicols gives a fine aggregate polarization effect.

No. 3. Obsidian—Near Black Rock, Millard County, Utah.

Ref. O. E. Meinzer. U. S. Geological Survey Water Supply Paper 277.

MACROSCOPIC: The rock is a jet black glass with conchoidal fracture. Light bluish gray spherules varying up to one half inch in diameter are disseminated throughout the rock.

MICROSCOPIC: The rock is largely a clear glass with abundant trichites arranged in a parallel manner showing flow structure. A few lath-shaped crystals of orthoclase occur with the long axes parallel to the direction of flow. Very small grains of magnetite are quite abundant. The spherules are brown and filled with trichites. Between crossed nicols they give a slight polarization effect in the form of innumerable incomplete crosses.

No. 4. Perlite—Nathrop, Chaffee County, Colorado.

Ref. None.

MACROSCOPIC: Gray, glassy rock with perlitic development. Small black nodules of obsidian are enclosed in some of the perlites.

MICROSCOPIC: The rock is a colorless glass showing beautiful perlitic development. There are a few phenocrysts of clear plagioclase and abundant very small specks of opaque mineral, probably magnetite.

No. 5. Vitrophyre—Long's Gulch, 2 miles East of Brown's Canyon, Chaffee County, Colorado.

Ref. R. D. Crawford. Colorado Geological Survey Bulletin 4. Page 174. Called pitchstone porphyry in this paper.

MACROSCOPIC: Dark colored rock with crystals of quartz, feldspar and biotite in a black glassy groundmass.

MICROSCOPIC: The rock is composed of clear crystals of quartz, orthoclase, plagioclase showing albite twinning or zonal structure, green hornblende, biotite, magnetite, titanite and small crystals of zircon and tourmaline in a glassy basis which curves around the phenocrysts due to flow and is filled with microlitic inclusions.

II. Rhyolite-Granite Series:

No. 6. Rhyolite—Ruby Mountain, Nathrop, Chaffee County, Colorado.

Ref. R. D. Crawford. Colorado Geological Survey Bulletin 4. Page 172.

MACROSCOPIC: Light gray rock with an earthy appearance. It shows fine parallel lines due to flow and lithophysae with crystalline linings.

MICROSCOPIC: Porphyritic texture. There are a few sharp phenocrysts of plagioclase in a groundmass composed of a blurred aggregate of quartz and feldspar. The grains of the groundmass are elongated in the direction of flow. Granular quartz fills crevices and lithophysae. Small grains of magnetite are quite abundant.

No. 7. Felsite (Aporhyolite)—Hyde Park, Massachusetts.

Ref. F. Bascom. The Petrographic Province of Neponset Valley, Massachusetts. Journal of the Academy of Natural Sciences of Philadelphia. Vol. XV. 1912. Page 141.

MACROSCOPIC: Red, felsitic rock with occasional small flakes of mica, quartz crystals and cherty patches.

MICROSCOPIC: Porphyritic texture. The groundmass generally shows aggregate polarization effects. Minute scales of mica are disseminated throughout it. In places the groundmass is more coarsely crystalline and is composed of intergrowths of quartz and feldspar. Large phenocrysts of quartz, orthoclase and plagioclase are present in this part. There are a few crystals of magnetite and much leucoxene in irregular smears. Secondary calcite is quite abundant.

No. 8. Quartz-Felsite Porphyry—Marblehead, Massachusetts.

Ref. J. H. Sears. The Physical Geography, Geology, Mineralogy and Paleontology of Essex County, Massachusetts. Page 222.

MACROSCOPIC: Dark gray, compact, porphyritic rock with phenocrysts of feldspar, quartz and biotite in a cryptocrystalline groundmass.

MICROSCOPIC: Porphyritic texture. The phenocrysts are principally plagioclase with irregular inclusions of epidote. There are a few quartz crystals and biotite altered to chlorite. Apatite and magnetite occur as accessory minerals. The groundmass is composed of a fine crystalline aggregate of quartz, feldspar, chlorite, magnetite and leucoxene.

No. 9. Quartz-Felsite Porphyry—Albemarle County, Virginia.

Ref. None.

MACROSCOPIC: Red, porphyritic rock with small phenocrysts of brown feldspar in a red felsitic groundmass.

MICROSCOPIC: Porphyritic texture with a trachytoidal groundmass consisting of laths of orthoclase with interstitial quartz. Small grains and flecks of magnetite are very abundant. Minute specks of ferrite are dusted throughout the rock and there is considerable secondary calcite. The phenocrysts are greatly altered orthoclase and a few pseudomorphs of calcite and hematite presumably after the femic mineral. There is also an isotropic mineral that is probably fluorite.

No. 10. Rhyolite Porphyry—Carbonate Camp, 9 miles West of Deadwood, South Dakota.

Ref. U. S. Geographical and Geological Survey. Geology of the Black Hills of Dakota. 1880. Chapt. III. Sec. X. by H. Newton; Chapt. VII. Sec. III by J. H. Caswell.

MACROSCOPIC: Light colored rock with phenocrysts of light brown feldspar showing good cleavage and black glassy quartz in a light gray felsitic groundmass.

MICROSCOPIC: Porphyritic texture. Among the phenocrysts are orthoclase and acid plagioclase. Quartz crystals have been resorbed and are surrounded by a resorption zone. In some instances quartz has been formed around these zones in optical continuity with the original crystal. Biotite crystals have been bleached out and the iron content segregated into patches. The groundmass is a fine crystalline aggregate of feldspar and quartz and is clouded with minute crystallites and abundant ferrite. Calcite is present in the groundmass as well as in phenocrysts of feldspar. There are a few crystals of zircon.

No. 11. Rhyolite Porphyry (Nevadite)—Wichita Mountains, Oklahoma.

Ref. J. A. Taff. Geology of the Arbuckle and Wichita Mountains in Oklahoma. U. S. Geological Survey Professional Paper 31. Page 55.

MACROSCOPIC: Dark colored, porphyritic rock with phenocrysts of reddish feldspar in a black felsitic groundmass.

MICROSCOPIC: Porphyritic texture. The phenocrysts are corroded quartz, hornblende altering to chlorite, and clouded orthoclase. The groundmass is a confused crystalline mass consisting principally of quartz and feldspar arranged radially around the orthoclase phenocrysts. Small shreds of chlorite are abundant. The whole rock is dusted with minute specks of ferrite. Magnetite and zircon crystals are quite abundant. There are very small rods of an opaque mineral in the groundmass.

No. 12. Pumiceous Rhyolite—Ruby Mountain, Nathrop, Chaffee County, Colorado.

Ref. R. D. Crawford. Colorado Geological Survey Bulletin 4.

MACROSCOPIC: Pink colored rock with an earthy appearance and a gritty feel.

MICROSCOPIC: The rock is composed almost entirely of glass showing flow lines. Part of the glass is colorless and part is brownish, the latter having the higher index of refraction. Minute crystallites of feldspar are abundant. There are a few small phenocrysts of quartz and feldspar.

No. 13. Porphyritic Granite—Winchester, Massachusetts.

Ref. None.

MACROSCOPIC: Porphyritic rock with red phenocrysts of feldspar in a greenish granular groundmass consisting of quartz, gray feldspar and altered feldspar.

MICROSCOPIC: Uneven granular texture. The porphyritic texture is not marked. The rock contains quartz showing undulatory extinction, orthoclase and acid plagioclase clouded by alteration. Chlorite shows Prussian blue interference color and is filled with grains of a high refracting mineral probably derived from the alteration of biotite. Titanite occurs in large grains. There are grains and crystals of magnetite, zircon, apatite and pyrite. Epidote grains are very abundant.

No. 14. Binary Granite—Concord, New Hampshire.

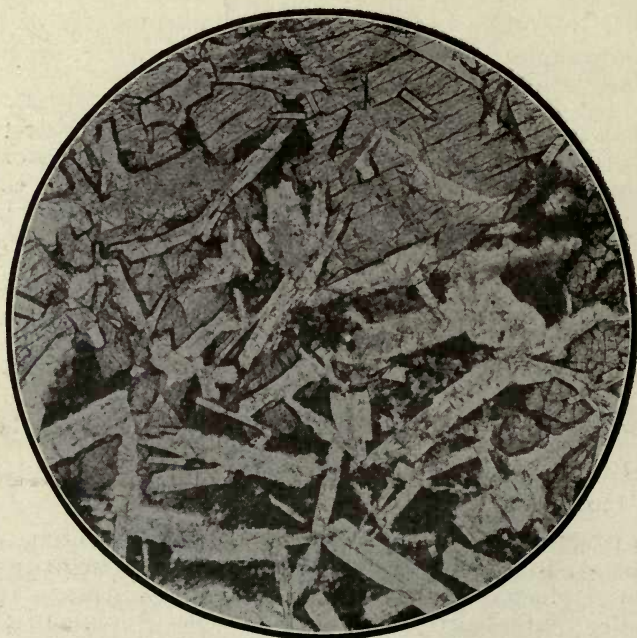
Ref. T. N. Dale. U. S. Geological Survey Bulletin 354. Page 145.

MACROSCOPIC: Light colored, medium grained rock composed of feldspar, quartz, biotite and muscovite.

MICROSCOPIC: Granitoid texture. Composed of quartz showing undulatory extinction and containing hair-like inclusions of rutile, orthoclase and acid plagioclase partially altered to sericite, fresh microcline showing lattice twinning, biotite with abundant pleochroic halos and muscovite. Accessory minerals are apatite, zircon, rutile and magnetite.



Photomicrograph of No. 15—Binary Granite $\times 36$



Photomicrograph of No. 46—Diabase $\times 100$

No. 15. Binary Granite—One mile North of Mear's Junction, Chaffee County, Colorado.

Ref. None.

MACROSCOPIC: Medium grained, pink rock with moderate gneissic structure. Bands of almost pure quartz and feldspar alternate with those containing considerable biotite and muscovite.

MICROSCOPIC: Granitoid texture. The section is composed almost entirely of feldspar and quartz. The quartz shows undulatory extinction. The feldspar is orthoclase and acid plagioclase showing fine albite twinning. There are a few very small grains of microcline showing lattice twinning. Small flakes of muscovite and biotite are not very plentiful. Magnetite grains are abundant in patches.

No. 16. Biotite-Granite—Westerly, Rhode Island.

Ref. T. N. Dale. U. S. Geological Survey Bulletin 354. Page 188.

MACROSCOPIC: Rather fine grained, pink rock consisting of feldspar, quartz and biotite.

MICROSCOPIC: Fine even hypidiomorphic texture. The essential constituents are acid plagioclase, orthoclase, microcline, quartz, biotite and muscovite. The microcline is fresh and shows lattice twinning while the other feldspars are altered to sericite. Biotite is sometimes altered to chlorite. The quartz shows undulatory extinction. Accessories are magnetite crystals and grains, apatite and a few small zircon grains. There is a small amount of secondary calcite.

No. 17. Biotite-Granite—Woodbury, Vermont.

Ref. T. N. Dale. U. S. Geological Survey Bulletin 404.

MACROSCOPIC: Gray, medium grained rock consisting of feldspar, quartz, biotite and muscovite.

MICROSCOPIC: Hypidiomorphic texture. The rock consists of fresh microcline showing lattice twinning, orthoclase and acid plagioclase somewhat altered to sericite. The plagioclase shows zonal structure. Also quartz in large clear grains or in micropegmatitic intergrowth with feldspar, biotite sometimes fresh and sometimes partially altered to chlorite, and muscovite. The accessories are apatite and zircon crystals, irregular grains of titanite and some epidote.

No. 18. Alkali Granite—Quincy, Massachusetts.

Ref. C. H. Warren. Petrology of the Alkali Granites and Porphyries of Quincy and the Blue Hills, Massachusetts. Proceedings American Academy of Arts and Sciences. Vol. 49, No. 5, Pages 203 to 331.

MACROSCOPIC: Dark gray, granular rock consisting of feldspar, hornblende and quartz.

MICROSCOPIC: Hypidiomorphic texture. The essential constituents are microcline-albite micropertthite, quartz, green aegirite closely associated with blue pleochroic riebeckite and brown cataphorite. Magnetite, zircon and fluorite are accessory minerals. Aenigmatite and astrophyllite may occur but were not observed in the slide examined. Some pyrite has filtered into the rock.

No. 19. Hornblende-Granite—Rockport, Massachusetts.

Ref. T. N. Dale. U. S. Geological Survey Bulletin 354. Page 121.

MACROSCOPIC: Gray, granular rock consisting of feldspar, smoky quartz and biotite.

MICROSCOPIC: Hypidiomorphic texture. The most abundant constituent is a microcline micropertthite. Large quartz grains show undulatory extinction. A few individual grains of plagioclase occur. Biotite and hornblende are closely associated with magnetite, zircon and large grains of fluorite. A small amount of pyrite is present. Secondary limonite and hematite are dusted throughout the slide.

No. 20. Pegmatite—Bedford, New York.

Ref. C. R. Fetteke. The Manhattan Schist of Southeastern New York and Its Associated Igneous Rocks.

Annals New York Academy of Science. Vol. XXIII. Page 235.

MACROSCOPIC: Light colored, coarse textured rock with pegmatitic intergrowth of pink feldspar and glassy quartz.

MICROSCOPIC: Coarse pegmatitic intergrowth of quartz and acid plagioclase. The plagioclase is slightly clouded and shows irregular albite twinning. There is a very small amount of muscovite.

III. Trachyte-Syenite Series:

No. 21. Sanidine-Trachyte—Near Salida, Chaffee County, Colorado.

Ref. None.

MACROSCOPIC: Brown, porphyritic rock containing small phenocrysts of biotite and glassy sanidine in a compact groundmass. Small lithophysae may be seen lined with white crusts.

MICROSCOPIC: Porphyritic texture. Sanidine and a few plagioclase phenocrysts and biotite occur in a yellowish clouded glassy groundmass. In places the groundmass is finely crystalline. Magnetite and zircon grains are also present.

No. 22. Trachyte Porphyry—Deadwood, South Dakota.

Ref. J. H. Caswell and H. Newton. Geology of the Black Hills of Dakota. U. S. Geographical and Geological Survey, 1880. Chapt. III. Sec. X. (Newton). Chapt. VII. Sec. III. (Caswell).

MACROSCOPIC: Gray, porphyritic rock with phenocrysts of feldspar and hornblende in a fine granular groundmass.

MICROSCOPIC: Porphyritic rock with phenocrysts of orthoclase and acid plagioclase. Also crystals of aegirite with zonal structure. The groundmass is a crystalline aggregate of lath-shaped orthoclase and shreds of aegirite. A few grains of titanite and pyrrhotite are accessory and small patches of calcite are secondary.

No. 23. Bostonite—Essex County, New York.

Ref. J. F. Kemp and V. F. Marsters. U. S. Geological Survey Bulletin 107.

MACROSCOPIC: Pink colored, felsitic rock with small phenocrysts of orthoclase.

MICROSCOPIC: Porphyritic texture with a few phenocrysts of clouded orthoclase. The groundmass consists of clouded lath-shaped feldspar crystals with irregular grains of interstitial quartz; also a lot of very small grains of magnetite and pyrite. There is a little secondary chlorite and many small patches of secondary calcite.

No. 24. Quartz-Syenite—Ticonderoga, New York.

Ref. J. F. Kemp and R. Ruedemann. Geology of the Elizabethtown and Port Henry Quadrangles. New York State Museum Bulletin 138. Page 44.

MACROSCOPIC: Dark green, granular rock resembling gabbro. Green feldspar and black hornblende are visible to the unaided eye.

MICROSCOPIC: Hypidiomorphic texture. The most abundant constituent is a microperthitic feldspar. Plagioclase and quartz are quite common. Deep brown hornblende and green aegirite are the femic minerals. The accessories are zircon and apatite crystals, abundant magnetite and some pyrite. Some secondary calcite is present.

No. 25. Hornblende-Syenite—Cuttingsville, Vermont.

Ref. J. W. Eggleston. Not yet published.

MACROSCOPIC: Granular, gray rock composed principally of feldspar showing good cleavage and considerable hornblende.

MICROSCOPIC: Granitoid texture. The rock is composed of clouded intergrown orthoclase and acid plagioclase, biotite and brown hornblende partially automorphic, abundant grains of magnetite, large crystals and grains of titanite, good crystals of apatite and a small amount of secondary sericite in small flakes.

No. 26. Monzonite—Near Silverton, San Juan County, Colorado.

Ref. Whitman Cross and Ernest Howe. U. S. Geological Survey Atlas Folio 120. Silverton Quadrangle.

MACROSCOPIC: Gray, granular rock consisting of plagioclase, orthoclase, biotite, hornblende, magnetite and pyrite.

MICROSCOPIC: Hypidiomorphic texture resembling porphyritic. Orthoclase and plagioclase crystals are developed to a considerable size. The orthoclase is clouded with secondary kaolin while the plagioclase is altered to sericite and epidote. Biotite crystals are altered to chlorite with epidote and titanite as by-products. Hornblende crystals are still quite fresh. A granular aggregate of quartz, orthoclase and plagioclase fills the space between the larger crystals. Magnetite is quite abundant while small crystals of apatite and grains of zircon are less common.

IV. Phonolite-Nephelite-Syenite Series:

No. 27. Phonolite—Beacon Hill, Cripple Creek District, Colorado.

Ref. Waldemar Lindgren and F. L. Ransome. U. S. Geological Survey Professional Paper 54. Geology and Gold Deposits of the Cripple Creek District, Colorado.

MACROSCOPIC: Dark gray, greasy, felsitic rock.

MICROSCOPIC: Trachytoidal texture. The rock consists predominantly of long slender laths of soda-orthoclase with the long axes all oriented in the same direction. Small nephelite crystals are nearly square in outline. Aegirite individuals are poorly defined but quite abundant. Small isotropic crystals of sodalite and noselite are indistinguishable from each other. An isotropic mineral filling cavities is probably analcite. Abundant small magnetite grains, titanite, zircon and crystals of apatite are the accessories. Secondary calcite and sericite are quite common.

No. 28. Leucite-Syenite—Magnet Cove, Arkansas.

Ref. J. F. Williams. Annual Report of the Geological Survey of Arkansas for 1890. Vol. II. Pages 342, 343. Igneous Rocks.

MACROSCOPIC: Large, rounded pseudoleucite crystals are embedded in a brownish groundmass which is itself porphyritic containing phenocrysts of feldspar.

MICROSCOPIC: The section at hand does not include the pseudoleucite. The groundmass is crystalline and consists of orthoclase and nephelite both of which are clouded with secondary alteration products. Magnetite in small grains and crystals is very abundant, also a few grains of tourmaline and titanite. Secondary calcite and sericite are quite common. Femic mineral is not present but faintly brownish areas composed of magnetite, calcite and quartz may have been some femic mineral.

No. 29. Nephelite-Syenite—Salem Neck, Massachusetts.

Ref. J. H. Sears. The Physical Geography, Geology, Mineralogy and Paleontology of Essex County, Massachusetts, 1905. Page 189.

MACROSCOPIC: Granular, gray rock composed largely of feldspar with small grains of ferromagnesian mineral. Many of the feldspars show good crystal form.

MICROSCOPIC: The slide is composed mainly of intergrowths of orthoclase, acid plagioclase, microcline and nephelite with a small amount of deep green aegirite in irregular patches and crystals of reddish brown biotite. There are many grains of magnetite and a few good crystals of apatite. A small amount of secondary calcite is present.

No. 30. Nephelite-Cancrinite-Syenite—Litchfield, Maine.

Ref. W. S. Bayley. Bulletin of the Geological Society of America, Vol. III. 1882. Page 231.

MACROSCOPIC: Granular rock consisting of yellow cancrinite, biotite, feldspar and nephelite.

MICROSCOPIC: Hypidiomorphic texture. The essential constituents are clear orthoclase, albite showing twinning lamellae, microcline showing lattice twinning, nephelite more altered than the feldspars, cancrinite with brilliant interference colors, deep green lepidomelane and a few sodalite grains. There is a small amount of zircon, magnetite and secondary calcite and muscovite.

No. 31. Essexite—Salem Neck, Massachusetts.

Ref. J. H. Sears. The Physical Geography, Geology, Mineralogy and Paleontology of Essex County, Massachusetts. 1905. Chapt. VII.

MACROSCOPIC: Dark colored, porphyritic rock with small phenocrysts of plagioclase, hornblende and biotite in a granular groundmass. A small amount of graphite may also be seen.

MICROSCOPIC: Porphyritic texture. The chief phenocryst is plagioclase with irregular inclusions of orthoclase and nephelite. The groundmass is granular and consists chiefly of femic minerals which are green and brown hornblende, biotite and augite often surrounded by green hornblende. Orthoclase, nephelite and cancrinite also occur in the groundmass. Irregular grains of titanite are quite abundant. Small crystals of apatite and zircon and grains of pyrite and magnetite are less common.

V. Dacite-Quartz-Diorite Series:

No. 32. Mica Dacite—Sunshine Canyon, Boulder County, Colorado.

Ref. R. D. Crawford. Geology and Petrography of the Sugar Loaf District, Boulder County, Colorado. University of Colorado Studies. Vol. 6, Page 125.

MACROSCOPIC: Light gray porphyritic rock with abundant phenocrysts of lustrous biotite, milky feldspar and a few corroded quartz crystals in a matted gray groundmass.

MICROSCOPIC: Porphyritic texture. Large phenocrysts of corroded quartz, fresh biotite and partially altered plagioclase are embedded in a fine crystalline groundmass. The groundmass consists of a very fine confused aggregate of feldspar, quartz and muscovite and biotite shreds with abundant secondary calcite. There are a few grains of magnetite and zircon and some crystals of apatite, some of which are quite large.

No. 33. Granodiorite—St. Cloud, Minnesota.

Ref. Warren Upham. Geological and Natural History Survey of Minnesota. Vol. II, 1888. Page 455. The rock is called syenite in this paper.

MACROSCOPIC: Medium granular rock of gray color, composed of plagioclase, orthoclase, quartz, biotite and hornblende.

MICROSCOPIC: Hypidiomorphic texture. The essential minerals are quartz, microcline, plagioclase, biotite and green hornblende and a small amount of micropegmatite. The feldspars are slightly clouded. The accessory minerals are grains of magnetite, pyrite, apatite and zircon. There is also a small amount of secondary calcite and sericite, the latter largely in the feldspar.

No. 34. Quartz-Monzonite Porphyry—Garfield, Chaffee County, Colorado.

Ref. R. D. Crawford. Colorado Geological Survey Bulletin 4.

MACROSCOPIC: Gray, porphyritic rock. Phenocrysts of pink orthoclase may be an inch long. Smaller phenocrysts of white feldspar, quartz, hornblende and mica are in a granular groundmass.

MICROSCOPIC: Porphyritic texture. The rock consists of phenocrysts of albite-oligoclase, quartz, biotite and hornblende in a granular groundmass consisting of quartz, orthoclase and plagioclase. Magnetite, apatite and titanite are abundant accessory constituents while zircon is less abundant. The biotite and hornblende are somewhat altered to chlorite and the feldspar to sericitic aggregates. Some secondary epidote is present.

VI. Andesite-Diorite Series:

No. 35. Hornblende-Andesite—1 mile East of Monarch, Chaffee County, Colorado.

Ref. R. D. Crawford. Colorado Geological Survey Bulletin 4.

MACROSCOPIC: Very dark rock with light brown phenocrysts of feldspar, hornblende and biotite in a black aphanitic groundmass.

MICROSCOPIC: Porphyritic texture. The rocks consist of large phenocrysts of clear labradorite, smaller ones of clear brown hornblende, prismatic crystals of apatite, magnetite, zircon and titanite in a groundmass composed of lath-shaped crystals of acid plagioclase and glass well clouded with crystallites. Secondary calcite is abundant in places.

No. 36. Andesite Porphyry—Newton, Massachusetts.

Ref. None.

MACROSCOPIC: Grayish-green porphyritic rock with light colored, somewhat greenish feldspar phenocrysts in a very fine groundmass.

MICROSCOPIC: Porphyritic texture. The plagioclase phenocrysts are altered and contain epidote and quartz as alteration products. Epidote grains also occur in the groundmass. The groundmass consists essentially of very small plagioclase laths and chlorite. Magnetite crystals and grains are very abundant and also very small grains of an undeterminable mineral with high index of refraction. Calcite and shreds of sericite also occur in the groundmass.

No. 37. Andesite Porphyry—Near Ward, Boulder County, Colorado.

Ref. R. D. Crawford. "Intrusive Rocks" in "The Main Tungsten Area of Boulder County." Colo. Geol. Survey First Report, 1908. Page 24.

MACROSCOPIC: Light gray porphyritic rock with phenocrysts of hornblende and plagioclase in a fine crystalline groundmass.

MICROSCOPIC: Porphyritic texture with small phenocrysts of plagioclase and a few of hornblende in a very fine confused crystalline groundmass. The plagioclase phenocrysts are somewhat clouded due to alteration and show irregular albite twinning. In a few cases they show zonal development. The hornblende phenocrysts are partially altered to chlorite and calcite. The groundmass is a fine irregular aggregate of quartz, orthoclase, plagioclase and green hornblende with abundant secondary epidote, chlorite and calcite. There are also a few crystals of apatite and abundant magnetite.

No. 38. Andesite Breccia—Near Ouray, Colorado.

Ref. Whitman Cross and Ernest Howe. U. S. Geological Survey Atlas Folio 153.

MACROSCOPIC: Compact rock with angular fragments of light green extrusive material embedded in a purplish groundmass.

MICROSCOPIC: The slide shows porphyritic texture with large phenocrysts of feldspar largely changed to calcite embedded in a fine groundmass showing aggregate polarization. Albite twinning can be noted in some of the feldspars. A few small quartz grains and greatly altered biotite crystals also occur as phenocrysts. Magnetite, ilmenite coated with leucoxene, and small apatite crystals are quite abundant. Faintly pleochroic chlorite is very abundant in the groundmass.

No. 39. Hornblende-Diorite—Salem, Massachusetts.

Ref. J. H. Sears. The Physical Geography, Geology, Mineralogy and Paleontology of Essex County, Massachusetts. 1905. Page 210.

MACROSCOPIC: Dark greenish-gray, very fine grained rock composed of plagioclase and hornblende. A few grains of pyrite and stringers of calcite are visible. The greenish color is probably due to chlorite.

MICROSCOPIC: Granitoid texture. The slide is composed principally of orthoclase and oligoclase clouded with shreds of sericite. The dark mineral is brown pleochroic hornblende, colorless augite and chlorite with anomalous blue interference colors. The chlorite appears to be an alteration product of biotite and contains abundant titanite as a byproduct of this alteration. Magnetite, pyrite and clear crystals and grains of apatite are quite abundant.

VII. Basalt-Gabbro Series:

No. 40. Hornblende-Basalt—Near Salida, Chaffee County, Colorado.

Ref. None.

MACROSCOPIC: Very fine granular rock of a brownish color with light green stringers in it.

MICROSCOPIC: Porphyritic texture with few small phenocrysts of labradorite. The groundmass is holocrystalline consisting principally of lath-shaped plagioclase with abundant brown hornblende, some augite crystals, abundant small grains and crystals of magnetite, some pyrite and apatite crystals. In places the slide is colored with filmy limonite.

No. 41. Olivine-Basalt Porphyry—Valmont, Boulder County, Colorado.

Ref. R. D. Crawford. Colorado Geological Survey First Report, 1908. Page 31.

MACROSCOPIC: Black, fine grained, porphyritic rock with apparent phenocrysts of augite and olivine in a fine crystalline groundmass.

MICROSCOPIC: Porphyritic texture. The rock consists of sharp phenocrysts of augite, olivine and a few lath-shaped plagioclases in a groundmass consisting of lath-shaped plagioclase, grains of olivine, augite, abundant magnetite and crystals of apatite. Some secondary chlorite is present in the groundmass.

No. 42. Dolerite Porphyry—Cape Ann, Massachusetts.

Ref. N. S. Shaler. The Geology of Cape Ann, Massachusetts. U. S. Geological Survey Ninth Annual Report, 1888. Page 529.

MACROSCOPIC: Dark colored, porphyritic rock. Consists of large phenocrysts of plagioclase in a diabase groundmass.

MICROSCOPIC: Porphyritic texture with large phenocrysts of oligoclase-andesine. The groundmass is a rather confused aggregate of biotite, sometimes partially altered to chlorite, augite partially altered to uraninite, and plagioclase. Titanite, a small amount of pyrite, abundant magnetite, crystals of apatite and a few crystals of zircon constitute the accessory minerals. There is a small amount of secondary calcite.

No. 43. Vesicular Basalt—Tenderfoot Mountain, $\frac{1}{4}$ mile North of Salida, Chaffee County, Colorado.

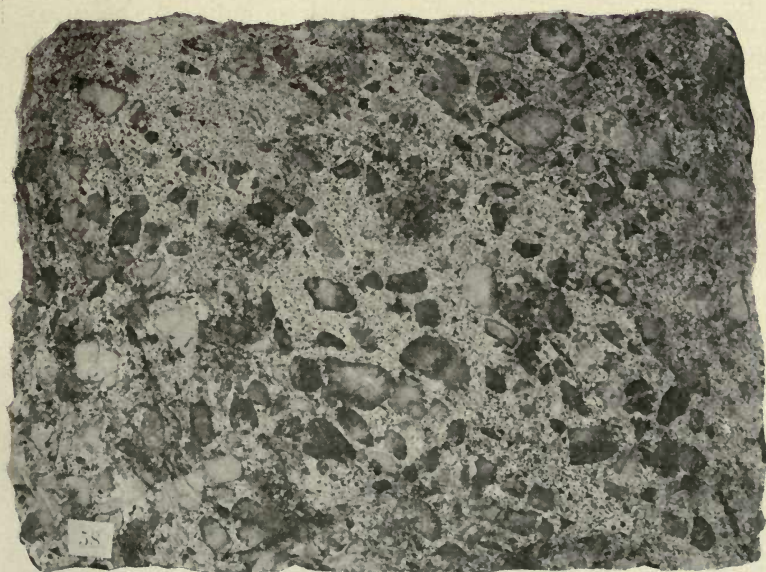
Ref. None.

MACROSCOPIC: Black, semiglassy rock containing abundant amygdules lined with a thin white crust of opaline material. A few small phenocrysts of augite and feldspar may be seen.

MICROSCOPIC: Porphyritic texture. The rock consists of small sharp lath-shaped crystals of labradorite, small crystals and grains of augite and abundant small crystals and grains of magnetite in a black glassy groundmass.



No. 42—Dolerite Porphyry



No. 58—Jasper-Conglomerate

No. 44. Amygdaloidal Diabase—Houghton County, Michigan.

Ref. A. C. Lane. The Keweenaw Series of Michigan. Michigan Geological and Biological Survey Publication 6, Geological Series 4, 1909.

MACROSCOPIC: Purplish, compact, extrusive rock with innumerable amygdules of varying size filled largely with quartz and epidote.

MICROSCOPIC: The groundmass is composed of small lath-shaped plagioclase crystals with interstitial chlorite and in it are grains of augite and large crystals of labradorite. The augite grains are partially altered around the edges to hematite and an opaque dust-like material. There are circular or oval patches consisting of clear lath-shaped plagioclase with a small amount of interstitial augite. A fine fibrous mineral, probably chlorite, is very common and chlorite occurs in patches of considerable size. There are also small grains of olivine. The amygdules are filled with epidote and granular quartz.

No. 45. Quartz-Diabase—Suffern, New York.

Ref. N. H. Darton. U. S. Geological Survey. Bulletin 67. Page 53.

MACROSCOPIC: Black, aphanitic rock showing columnar parting.

MICROSCOPIC: Intersertal texture. The interstitial materials are augite, chlorite and quartz between small, clear, lath-shaped crystals of labradorite. There is considerable magnetite in the section.

No. 46. Diabase—Chimney Rock, Somerset County, New Jersey.

Ref. J. V. Lewis. Bulletin Geological Society of America. Vol. 18, 1907. Pages 195 to 210.

MACROSCOPIC: Greenish-black rock with an aphanitic texture.

MICROSCOPIC: Ophitic texture. Small lath-shaped crystals of labradorite are wholly or partially enclosed in larger clear augite grains. In places iron oxide is very abundant and colors the slide red. Small grains of magnetite and leucoxene are very abundant. Chlorite and calcite are common interstitial materials.

No. 47. Diabase—Somerville, Massachusetts.

Ref. W. H. Hobbs. On the Petrographical Character of a Dike of Diabase in the Boston Basin. Bulletin of the Museum of Comparative Zoology, Harvard. Vol. XVI. No. 1, 1888.

MACROSCOPIC: Coarse grained, greenish-gray rock showing diabase texture. Composed of labradorite, biotite and pyroxene.

MICROSCOPIC: Coarse diabase texture. The principal constituent is labradorite filled with flakes and shreds of sericite. Biotite is partially altered to chlorite and chlorite also fills interstices between the feldspar laths. Colorless augite is often surrounded by a zone of green uraltite. Brown hornblende is less common. Titaniferous magnetite partially altered to leucoxene, titanite both primary and secondary, large apatite crystals and small grains of pyrite are the accessory constituents. Secondary calcite is quite abundant.

No. 48. Olivine-Augite-Hypersthene Gabbro—Wichita Mountains, Oklahoma.

Ref. Joseph A. Taff. Geology of the Arbuckle and Wichita Mountains. U. S. Geological Survey Professional Paper 31.

MACROSCOPIC: Dark colored, granitoid rock of medium grain. Consists of glassy plagioclase, part of which is granular and part shows elongated rectangular development, and flakes of biotite.

MICROSCOPIC: Labradorite, the most abundant constituent, shows albite twinning occasionally combined with Manebach. It often contains small rod-like inclusions in parallel arrangement. Fresh irregular grains of olivine with stringers of opaque material in it, clear grains of augite, hypersthene filled with regularly arranged inclusions and deep brown pleochroic biotite are the femic minerals. The accessories are irregular grains of magnetite and pyrrhotite and crystals of apatite.

No. 49. Hornblende-Gabbro—Salem Neck, Massachusetts.

Ref. J. H. Sears. The Physical Geography, Geology, Mineralogy and Paleontology of Essex County, Massachusetts, 1905. Page 210.

MACROSCOPIC: Coarse textured, dark colored rock composed of plagioclase, hornblende and biotite.

MICROSCOPIC: Hypidiomorphic texture. Essential minerals are labradorite showing sharp albite twinning, biotite, brown hornblende and augite. Also a few skeletal growths of olivine and magnetite. Apatite crystals, magnetite and pyrrhotite are abundant accessories. Some chlorite is associated with the femic mineral.

No. 50. Hypersthene-Gabbro (Norite)—Elizabethtown, Essex County, New York.

Ref. J. F. Kemp and R. Ruedemann. Geology of the Elizabethtown and Port Henry Quadrangles. New York State Museum Bulletin 138.

MACROSCOPIC: Granular, dark colored rock composed of plagioclase, biotite and pyroxene.

MICROSCOPIC: Coarse diabase texture. The principal constituent is lath-shaped labradorite with dust like inclusions. Hypersthene, granular patches of biotite, hornblende and olivine with magnetite stringers are the other essential minerals. There is a small amount of pyrrhotite and considerable titaniferous magnetite. Large amounts of garnet appear as a reaction product in the labradorite.

No. 51. Anorthosite—Lewis, Essex County, New York.

Ref. J. F. Kemp and R. Ruedemann. Geology of the Elizabethtown and Port Henry Quadrangles. New York State Museum Bulletin 138.

MACROSCOPIC: Coarse granular rock composed of light and dark plagioclase.

MICROSCOPIC: Granular rock consisting almost entirely of labradorite showing albite and pericline twinning. Some crystals contain abundant rod-like inclusions of ilmenite regularly arranged. There is a small amount of hornblende altering to chlorite and a few small grains of magnetite and titanite. Flakes of sericite and stringers of calcite occur as secondary minerals.

VIII. Pyroxenite-Peridotite Series:

No. 52. Pyroxenite (Bronzite)—Near Webster, North Carolina.

Ref. J. H. Pratt and J. V. Lewis. North Carolina Geological Survey, Vol. I. 1905. Page 98.

MACROSCOPIC: Brownish granular rock composed largely of fibrous bronzite with good cleavage. A small amount of granular green diopside may be seen between the bronzite crystals and small crystals of chromite are also apparent.

MICROSCOPIC: In thin section the colorless fibrous bronzite constitutes most of the rock with smaller grains of diopside lying between them. The diopside is sometimes colorless and sometimes pale green and slightly pleochroic. Small chromite grains are brownish in transmitted light but are almost opaque.

No. 53. Peridotite (Lherzolite)—Near Baltimore, Maryland.

Ref. G. H. Williams. U. S. Geological Survey Bulletin 28.

MACROSCOPIC: Granular, greenish-black rock composed of green and black femic minerals and no feldspar. Cleavage faces on the femic mineral resemble mica flakes in places.

MICROSCOPIC: The slide presents quite a confused appearance due to alteration of the constituents in which the secondary minerals partially replace the primary constituents and overlap the other grains. Olivine is an abundant constituent. It is partially altered to serpentine and magnetite which fill cracks in the olivine giving rise to the mesh texture. Primary magnetite is also quite abundant. Chlorite occurs as an alteration product of an aluminous pyroxene, probably diallage. There is also a small amount of orthorhombic pyroxene.

No. 54. Dunite—Near Balsam, Jackson County, North Carolina.

Ref. J. H. Pratt and J. V. Lewis. North Carolina Geological Survey Vol. I, 1905. Page 101.

MACROSCOPIC: Light green, granular rock composed almost entirely of glassy olivine with small black grains of chromite and a few muscovite flakes of considerable size.

MICROSCOPIC: The slide is composed of a mosaic of clear olivine grains. A small amount of serpentine occurs in the cracks of the olivine. Stringers of carbonate, probably dolomite, wind across the section. Crystals and grains of chromite are slightly transparent and brown on the edges. Flakes of chlorite with anomalous brown interference colors are associated with the chromite. A small amount of fibrous cumingtonite may also be seen.

No. 55. Cortlandtite—Syracuse, New York.

Ref. G. H. Williams. *American Journal of Science*. Vol. 34, 1887. Page 137.

MACROSCOPIC: Black, compact rock with some large crystals of hornblende and olivine.

MICROSCOPIC: Porphyritic texture. Sharply defined pseudomorphs of serpentine after olivine and enstatite in a confused groundmass of serpentine, calcite and chlorite. Remnants of the original mineral of the pseudomorphs are sometimes visible. There are a few small brown flakes of biotite. Small brownish crystals of perovskite and black chromite are very abundant.

No. 56. Kimberlite—Kimberley, South Africa.

Ref. P. A. Wagner. *Die Diamantführenden Gesteine Südafricas*. Berlin. 1909.

MACROSCOPIC: Grayish-green, earthy appearing rock showing porphyritic texture. Large rounded phenocrysts of olivine, partially altered to serpentine, diopside and abundant black metallic mineral occur in a fine confused greenish groundmass.

MICROSCOPIC: Porphyritic texture. The slide presents a confused appearance due to alteration of the constituents. The phenocrysts are rounded olivine grains more or less altered to serpentine, biotite crystals in various stages of alteration to scaly chlorite, and clear diopside. Pyrope is quite abundant in small rounded grains. The groundmass is a confused mass of scaly chlorite and serpentine with grains of magnetite, pyrrhotite, ilmenite partly altered to leucoxene, and perovskite. Grains of secondary calcite are quite abundant.

B. Sedimentary Rocks

I. Breccias and Conglomerates:

No. 57. Limestone Breccia—Two-Mile Canyon, near Boulder, Colorado.

Ref. N. M. Fennemann. *U. S. Geological Survey, Bulletin 265*. Pages 24 to 26.

MACROSCOPIC: The rock has a reddish color and is composed of angular fragments of limestone and sandy shale with a calcareous cement.

MICROSCOPIC: The character of the slide must vary with the different parts of the rock. This one represents the more sandy shale phase and is composed of subangular grains of quartz, feldspar and muscovite with a small amount of magnetite and abundant calcite cement. Red oxide of iron is quite abundant.

No. 58. Jasper-Conglomerate—Lame Johnny Creek, near Buffalo Gap, South Dakota.

Ref. N. H. Darton. U. S. Geological Survey 21st Annual Report, 1899-1900. Part IV. Page 489.

MACROSCOPIC: The rock consists of small rounded pebbles of chert with a siliceous cement. The color of the chert pebbles may be white, yellow, brown, red, dark gray or black.

MICROSCOPIC: Some of the pebbles of the conglomerate are quartz either brecciated or showing undulatory extinction. Others are chert showing no polarization effect at all or only aggregate polarization. The cement is siliceous showing in most places aggregate polarization but some distinct grains of quartz may be seen. Red oxide of iron occurs everywhere and completely obscures portions of the slide.

No. 59. Quartz-Conglomerate—Titusville, Pennsylvania.

Ref. I. C. White. The Geology of Erie and Crawford Counties. Pennsylvania Second Geological Survey Q4, page 62. Sharon Conglomerate.

MACROSCOPIC: Variable sized pebbles of white quartz are cemented by a sandy cement.

MICROSCOPIC: Clastic texture. The slide consists of pebbles of quartz in a sandstone groundmass. The quartz pebbles consist of a granular aggregate of quartz without cement while the basis consists of rounded quartz grains with the cement washed out in the process of making the slide. A few grains of tourmaline and zircon occur in the sandstone.

No. 60. Copper Conglomerate—Demmon, Houghton County, Michigan.

Ref. A. C. Lane. The Keweenaw Series of Michigan. Michigan Geological and Biological Survey Publication 6, Geological Series 4, 1909.

MACROSCOPIC: Very coarse conglomerate consisting of rounded pebbles of felsite with a cement consisting of copper, epidote and calcite.

MICROSCOPIC: The slide is dusted with red oxide of iron and leucoxene which obscure many of the constituents. Fragments of felsite porphyry in which phenocrysts of quartz and acid plagioclase can be recognized in a fine crystalline groundmass are embedded in a cement consisting of a mixture of epidote grains, calcite, copper, quartz and feldspar.

II. Sandstones:

No. 61. Red Sandstone—Potsdam, New York.

Ref. E. Emmons. Geology of New York, Part II. Pages 102 and 360.

MACROSCOPIC: Fine grained, red quartz sandstone with occasional grains of magnetite. It shows bedding lines.

MICROSCOPIC: Clastic texture. It is composed of rounded grains of clear quartz with a siliceous cement in which shreds of sericite occur. The cement is in optical continuity with the original grains but is separated from them by a layer of iron oxide. In many instances the cement restores to a large extent the crystal outline of the original grains. A few small magnetite grains may be noted.

No. 62. Berea Grit—Berea, Ohio.

Ref. J. S. Newberry. Report of the Geological Survey of Ohio, Vol. II. Part I. Page 88.

MACROSCOPIC: Light gray, fine grained sandstone showing fine parallel bedding lines.

MICROSCOPIC: Clastic texture. It consists of subangular grains of quartz, orthoclase, plagioclase and microcline together with a few flakes of muscovite, small grains of zircon, pyrite and leucoxene. The cement is often obscured by dusty opaque material but is composed of calcite in part and of argillaceous material in which sericite shreds and small quartz grains may be recognized.

No. 63. Banded Sandstone—Near Buffalo Gap, South Dakota.

Ref. N. H. Darton. U. S. Geological Survey 21st Annual Report, Part IV. Page 489.

MACROSCOPIC: Reddish, even granular rock showing fine bedding lines.

MICROSCOPIC: Clastic texture. The rock consists of subangular grains of quartz with an argillaceous and ferruginous cement. There are a few grains of zircon and tourmaline.

No. 64. Brownstone—Portland, Connecticut.

Ref. W. N. Rice. State Geological and Natural History Survey of Connecticut, Bulletin 6. Page 163.

MACROSCOPIC: Dark reddish-brown sandstone showing fine bedding lamination. It is composed of grains of quartz, feldspar and muscovite with a ferruginous cement.

MICROSCOPIC: Clastic texture. The rock consists of rounded or subangular grains of quartz, orthoclase and acid plagioclase, flakes of muscovite and biotite, grains of fresh hornblende, brown tourmaline, zircon and garnet. There is a small amount of chlorite and calcite occurs in patches. Ferruginous cement surrounds the grains.

No. 65. Arkose—Hot Springs, North Carolina.

Ref. Arthur Keith. U. S. Geological Survey Atlas. Folio No. 116. Page 5.

MACROSCOPIC: Light gray, clastic rock composed principally of quartz with some feldspar. It appears to have been mashed to some extent.

MICROSCOPIC: The slide consists essentially of quartz, orthoclase and microcline grains that have been flattened in one direction. The quartz shows marked undulatory extinction indicating crushing action. These grains are cemented by a very fine granular cement which was probably originally clayey in nature but has changed to quartz and sericite. An opaque mineral resembling leucoxene occurs in irregular grains in the slide.

No. 66. Novaculite—Hot Springs, Arkansas.

Ref. L. S. Griswold. Arkansas Geological Survey Annual Report, Vol. III. Part 2, 1890.

MACROSCOPIC: Milky white, compact rock with a conchoidal fracture. It appears to be pure chert.

MICROSCOPIC: The rock consists of an extremely fine crystalline aggregate of chert with a few small grains of quartz. The slide is dusted with fine specks of an opaque mineral.

III. Argillaceous Sandstones, Shales and Calcareous Sandstones:

No. 67. Argillaceous Sandstone—Near Iron Point, Humboldt County, Nevada.

Ref. S. F. Emmons and A. Hague. U. S. Geological Exploration of the Fortieth Parallel, 1877. Part II. Chaps. IV. and V.

MACROSCOPIC: Very fine grained rock showing irregular banding in which red and gray bands alternate.

MICROSCOPIC: The bedding appears to be normal to the banding. The red bands are marked by a concentration of iron oxide which is lacking in the gray bands. The rock is composed of very fine irregular grains of quartz with abundant argillaceous cement in which shreds of sericite can be identified. A few grains of magnetite and zircon may be seen.

No. 68. Flagstone—Near Kingston, New York.

Ref. C. P. Berkey. Quality of the Bluestone in the Vicinity of the Ashokan Dam. School of Mines Quarterly, Vol. 29, 1908. Page 149.

MACROSCOPIC: Very fine, brownish, shaly sandstone. Quartz grains and flakes of muscovite are apparent.

MICROSCOPIC: Clastic texture. The rock is composed mostly of small irregular grains of quartz. Shreds of muscovite, chlorite and altered biotite are thickly disseminated throughout the slide. There are a few grains of zircon and tourmaline and ilmenite or rutile with a leucoxene coating.

No. 69. Arenaceous Shale—Rondout, New York.

Ref. N. H. Darton. New York State Museum Report 47. Pages 505—523.

MACROSCOPIC: Dark gray, gritty rock with irregular shaly partings.

MICROSCOPIC: Fragmental texture. The rock consists of angular grains of quartz and feldspar with an argillaceous cement. Fine shreds of sericite together with chlorite appear in the cement. There are also grains of tourmaline, zircon, pyrite, magnetite and leucoxene. Abundant ferrite pigment is present.

No. 70. Calcareous-Bituminous Shale—Los Angeles County, California.

Ref. G. H. Eldridge. U. S. Geological Survey Bulletin 213. Page 318.

MACROSCOPIC: Compact, black rock with conchoidal fracture.

MICROSCOPIC: The basis of the rock is chlorite so filled with brownish carbonaceous material as to have little effect on polarized light. In this are abundant grains and sharp rhombs of calcite and a few grains of quartz, feldspar, pyrite and magnetite.

No. 71. Calcareous Shale—Moscow, New York.

Ref. A. W. Grabau. Sixteenth Annual Report, New York State Geologist for 1896. Page 234.

MACROSCOPIC: Compact light gray rock. It does not show the thin shaly structure but appears more massive. It contains numerous fossils and effervesces freely with hydrochloric acid.

MICROSCOPIC: The slide is composed chiefly of small grains of calcite which obscure the other constituents. In some places minerals with low interference colors may be seen, among which chlorite may be identified. Pyrite is quite abundant in single grains and rod-like aggregates.

No. 72. Green Shale—Rochester, New York.

Ref. James Hall. Geology of New York, 1843. Part IV. Page 59.

MACROSCOPIC: Compact shaly rock with a green color. It has the shale structure but the lamellae are not very thin.

MICROSCOPIC: Fine clastic texture. The recognizable minerals are principally irregular quartz grains and abundant grains and rhombs of calcite. Grains of feldspar are less common but there are abundant flakes and shreds of sericite. There are also grains of pyrite, magnetite, zircon and a titanium mineral coated with leucoxene. Surrounding the grains and obscuring them to quite an extent is a greenish cloudy material that has little effect on polarized light and is probably largely chlorite.

No. 73. Carbonaceous Shale—Buck Mt. Vein, Luzerne County, Pennsylvania.

Ref. J. P. Lesley. Pennsylvania Summary Final Report, Volume III. Part I. Page 2039.

MACROSCOPIC: Dull black, shaly rock with fern impressions on some of the bedding surfaces.

MICROSCOPIC: The slide consists of a very fine aggregate of mica shreds and grains of quartz and feldspar. Abundant carbonaceous material smears the whole section. Small grains of magnetite are quite abundant.

No. 74. Green Sandstone—Hazlet, New Jersey.

Ref. J. K. Prather. *American Geologist*, Vol. 36, 1905. Page 162.

MACROSCOPIC: Greenish rock with seams of brown, the whole showing a texture resembling öolitic.

MICROSCOPIC: The rock consists of subangular grains of quartz and orthoclase and rounded grains of glauconite in a matrix of fine grains of dolomite and irregular chlorite. Brownish iron oxide pigment is abundant as is also pyrite in small grains. There are also grains of a black metallic mineral resembling magnetite. Sericite occurs in small shreds.

IV. Limestones and Dolomites:

No. 75. Coral Limestone—Clark County, Indiana.

Ref. T. C. Hopkins and A. F. Foerste. *Indiana Geological Survey 28th Annual Report*, 1903. Pages 15 to 79 and Map.

MACROSCOPIC: The hand specimen is a white columnar mass of *Favosites Emmonsii*.

MICROSCOPIC: The walls of the columns are aggregates of calcite that show only confused polarization effects while the interior is granular calcite. Some organic material obscures the slide in places.

No. 76. Encrinal Limestone—Lockport, New York.

Ref. James Hall. *Geology of New York*, Part IV. 1843. Page 65.

MACROSCOPIC: Dark gray, granular limestone containing crinoid fossils. Many of the crinoids are of a reddish color giving the rock a speckled appearance.

MICROSCOPIC: The rock consists of irregular forms of calcite that show no twinning and little cleavage with a fine granular calcite interstitial mass. The larger forms are undoubtedly fossil remains but cannot be identified.

No. 77. Pearly Shell Limestone—Rochester, New York.

Ref. James Hall. *Geology of New York*, Part IV. 1843. Page 62.

MACROSCOPIC: The rock is a dark gray mass of Leptocoeloid Brachiopods with a pearly luster.

MICROSCOPIC: The slide contains abundant fossil forms with an interstitial mass of fine granular calcite and grains of quartz.

No. 78. Argillaceous Limestone—Trenton Falls, New York.

Ref. L. Vanuxem. *Geology of New York*, Part III. 1842. Page 45.

MACROSCOPIC: Black, compact rock with conchoidal fracture. It contains a few brachiopod shells.

MICROSCOPIC: The slide is for the most part so fine that individual grains do not appear although some grains of calcite may be seen and a few grains of a low refracting mineral, probably quartz, are also apparent.

No. 79. Lithographic Limestone—Solenhofen, Bavaria.

Ref. Joh. Walther. Die Fauna der Solenhofener Plattenkalke. Abstracted in Neues Jahrbuch für Mineralogie, etc., 1905, Part I. Page 485.

MACROSCOPIC: Dense, yellowish rock with conchoidal fracture.

MICROSCOPIC: The section is composed of an aggregate of calcite so fine and so intergrown as to have little effect on polarized light. A few larger grains of calcite may be seen. Very small flecks of limonite are quite abundant.

No. 80. Cherty Limestone—Buffalo, New York.

Ref. A. W. Grabau. New York State Museum Bulletin 45. Page 105.

MACROSCOPIC: Compact, dark gray limestone with conchoidal fracture. Numerous irregular chert areas are a little lighter colored than the carbonate.

MICROSCOPIC: The slide consists of an intimate mixture of calcite and chert. In patches the carbonate predominates while in others the chert predominates. Sharp rhombs of carbonate occur in the more cherty areas. Small grains and specks of pyrite and ferrite are abundant.

No. 81. Hydraulic Limestone—Buffalo, New York.

Ref. A. W. Grabau. New York State Museum Bulletin 45. Page 105.

MACROSCOPIC: Drab colored, compact limestone with conchoidal fracture.

MICROSCOPIC: The section is extremely fine grained and shows bedding lines. It is composed of calcite so fine as to show no distinct polarization effect and abundant small grains of quartz and shreds of sericite. Very fine specks of pyrite and ferrite are quite abundant.

No. 82. Oolitic Limestone—Bedford, Indiana.

Ref. T. C. Hopkins and A. F. Foerste. Indiana Geological Survey 28th Annual Report, 1903. Page 53.

MACROSCOPIC: Grayish rock showing oolitic texture.

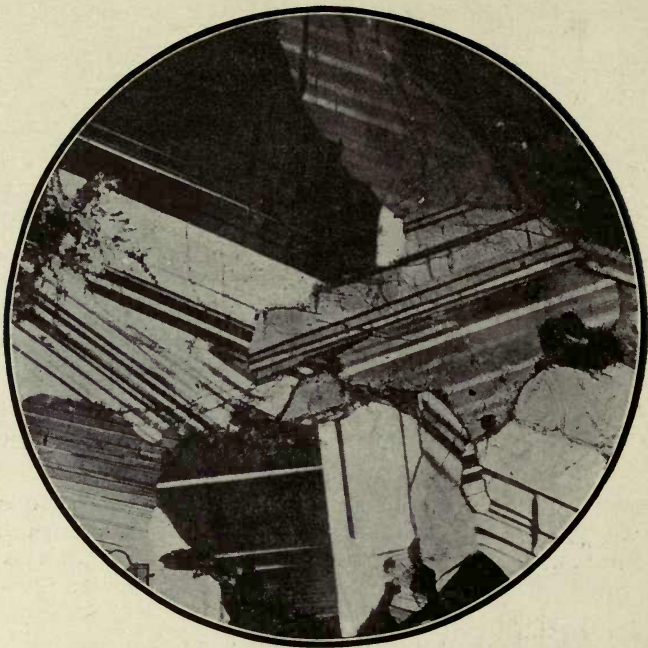
MICROSCOPIC: The rock is composed of an aggregate of oolites of calcite which, except for the central portion, have little effect on polarized light. They are cemented by a fine granular mass of calcite. A small amount of ferrite occurs in small flecks.

No. 83. Oolitic Limestone—Milton, Pennsylvania.

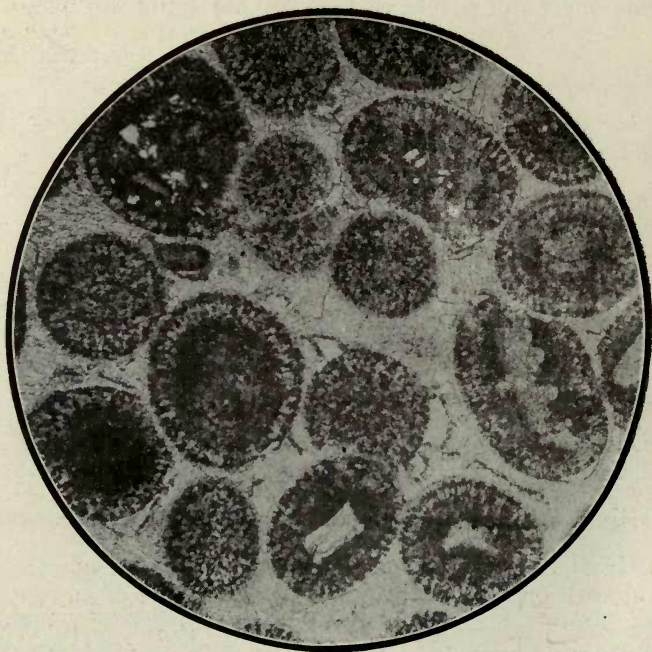
Ref. I. C. White. Geology of the Susquehanna River Region. Pennsylvania Second Geological Survey, G7, Page 331. Turbut Township.

MACROSCOPIC: Black limestone showing oolitic texture.

MICROSCOPIC: The slide consists of round oolites and more abundant foraminiferal forms in a crystalline groundmass of calcite. The oolites and foraminifera are very dark owing to a large amount of carbonaceous material and abundant fine pyrite grains. There are also quite a few small quartz grains in the rock.



Photomicrograph of No. 48—Olivine-Augite-Hypersthene Gabbro $\times 36$



Photomicrograph of No. 82—Oolitic Limestone $\times 36$

No. 84. Siliceous Dolomite—Little Falls, New York.

Ref. H. P. Cushing. The Geology of the Vicinity of Little Falls, Herkimer County. New York State Museum Bulletin 77, 1905.

MACROSCOPIC: Brownish-gray, very fine crystalline rock. Cavities may contain calcite or rock crystal. Pyrite is fairly abundant.

MICROSCOPIC: The slide is a fine mosaic of dolomite colored slightly brownish by foreign material. Several small grains of quartz lie between the larger dolomite grains.

No. 85. Dolomitic Limestone—Kasota, Minnesota.

Ref. Warren Upham. Geological and Natural History Survey of Minnesota, Vol. I. Page 636.

MACROSCOPIC: Yellowish-brown dolomitic rock having narrow alternating bands of gray and yellow. It has a gritty feel.

MICROSCOPIC: The rock is composed of an aggregate of rhombs and angular grains of dolomite with small quartz grains. The pigment is limonitic. There are many small irregular grains of magnetite.

No. 86. Birdseye Limestone—Watertown, New York.

Ref. H. P. Cushing. Bulletin of the Geological Society of America, Vol. 19, 1908. Page 155.

MACROSCOPIC: Dark gray, compact limestone with a conchoidal fracture containing small round light colored spots of crystalline calcite.

MICROSCOPIC: The rock is composed chiefly of an aggregate of calcite so fine that it does not affect polarized light. In it are network patches that resemble foraminifera, others that look like minute brachiopods and still others that look as though they might be archeocyathus or some similar form. Other areas are coarsely crystalline in character and may represent the remains of some organic form.

No. 87. Black Limestone—Isle la Motte, Vermont.

Ref. T. N. Dale. The Commercial Marbles of Western Vermont. U. S. Geological Survey Bulletin 521.

MACROSCOPIC: Fine, black, semi-crystalline limestone.

MICROSCOPIC: The rock consists essentially of calcite with sharp rhombs of dolomite embedded in the calcite. Fragments of many fossil forms may be observed. The pigment is a dark carbonaceous material. Some small grains of pyrite may be seen.

No. 88. Chocolate Marble—Knoxville, Tennessee.

Ref. C. H. Gordon. The Marbles of Tennessee. Tennessee Geological Survey Bulletin 2, 1911.

MACROSCOPIC: Brownish, partially crystalline limestone.

MICROSCOPIC: The rock is composed of calcite with a fine reddish pigment like ferrite scattered throughout it. Part of the calcite is distinctly crystalline and part is in distinct organic fossil forms which may be coralline in nature.

V. Siliceous Rocks:

No. 89. Diatomaceous Earth—Lompoc, Santa Barbara County, California.

Ref. R. Arnold and R. Anderson. U. S. Geological Survey Bulletin 315.
Page 438.

MACROSCOPIC: Soft, white chalky rock.

MICROSCOPIC: The slide consists of a brownish, almost nontransparent mass of diatoms with a few irregular grains of quartz.

No. 90. Flint—South Bethlehem, Pennsylvania.

Ref. Frederick Prime. Pennsylvania Second Geological Survey, D3, Vol. I.
Page 179.

MACROSCOPIC: Dense, black rock with a conchoidal fracture.

MICROSCOPIC: The section is composed of a very fine aggregate of chalcedony with larger grains of quartz and a small amount of disseminated carbonaceous material. In ordinary light it appears to consist largely of radiolarian remains which, between crossed nicols, are much finer grained than the surrounding material and probably contain also opaline silica. A few isolated rhombs of calcite appear here and there.

No. 91. Chert—Columbia, Missouri.

Ref. H. F. Bain. U. S. Geological Survey 22nd Annual Report, 1901, Part 2.
Page 121.

MACROSCOPIC: Dense, hard rock irregularly colored pink, red, brown, black and white.

MICROSCOPIC: The slide consists of a very fine groundmass of chalcedony showing dark crosses between crossed nicols. In it are small patches of granular quartz with sphalerite and pyrite. The metallic minerals are also disseminated to some extent in the groundmass.

No. 92. Geyserite—Yellowstone National Park, Wyoming.

Ref. W. H. Weed. Formation of Travertine and Siliceous Sinter by the Vegetation of Hot Springs. U. S. Geological Survey 9th Annual Report, 1888. Page 650.

MACROSCOPIC: White, earthy rock with botryoidal structure. It shows radial development in cross section.

MICROSCOPIC: The slide is composed of an aggregate of small grains of quartz and spherules of opal showing the black cross in parallel light.

No. 93. Siliceous Oolite—State College, Pennsylvania.

Ref. Victor Ziegler. American Journal of Science, 4th Series, Vol. XXXIV. 1912. Pages 113 to 127.

MACROSCOPIC: Light gray rock consisting of small, brownish, siliceous öolites cemented by light gray compact silica.

MICROSCOPIC: The circular öolites have a single grain or a granular aggregate of quartz grains in the center. Some of them have a grain of quartz surrounded by a granular aggregate of quartz. Surrounding this there are two or three zones of much finer grained material, the size of grain varying in the different zones. The cementing material is granular quartz, sometimes as coarse as the nucleus of the öolites and sometimes as fine as the outer zones.

VI. Chemical Precipitates:

No. 94. Travertine—Suisun, California.

Ref. J. D. Whitney. Geological Survey of California, Vol. I. Page 104.

MACROSCOPIC: Granular rock with a rosin-like appearance. It shows a radial fibrous structure with a concentric zonal development cutting across the fibers.

MICROSCOPIC: The slide is composed entirely of calcite some of which is granular but most of it is elongated sections arranged in a radial manner. The zones are separated by streaks of finer grained calcite.

No. 95. Anhydrite—Hillsboro, New Brunswick.

Ref. L. W. Bailey. Proceedings of the Royal Society of Canada, Vol. 12, Sec. 4, 1906. Page 3.

MACROSCOPIC: Fine grained, compact, bluish-white rock showing occasional cleavage faces.

MICROSCOPIC: The slide consists of a fine grained aggregate of anhydrite with broad veins of gypsum. The gypsum has lower index of refraction than the anhydrite and a very low double refraction while the anhydrite has higher index than anhydrite, high interference colors and a small optic angle.

No. 96. Gypsum—Grand Rapids, Michigan.

Ref. G. P. Grimsley. Geological Survey of Michigan, Vol. IX. Part II. 1904.

MACROSCOPIC: Soft, fine granular, pink rock.

MICROSCOPIC: The rock consists of a fine grained aggregate of gypsum with patches in which the grains are quite large. There are also a few sharply outlined crystals of gypsum.

No. 97. Oolitic Iron Ore—Clinton, New York.

Ref. D. H. Newland and C. A. Hartnagel. N. Y. State Museum Bulletin 123. Page 45.

MACROSCOPIC: Deep red hematite showing well developed öolitic texture.

MICROSCOPIC: The öolites of red hematite are elliptical in shape and have for a nucleus a rounded grain of clouded quartz. Around this the hematite is built up in narrow confocal elliptical zones. The öolites are cemented by red hematite. A small amount of chlorite and calcite occur as secondary minerals in veins and stringers.

C. Metamorphic Rocks

I. Gneisses and Crystalline Schists:

No. 98. Biotite-Gneiss—Uxbridge, Massachusetts.

Ref. J. H. Perry and B. K. Emerson. Geology of Worcester, Massachusetts: Worcester Natural History Society, 1903.

MACROSCOPIC: Banded rock. Thin bands of black mica alternate with those of quartz and feldspar.

MICROSCOPIC: Schistose texture. The chief constituents are quartz, plagioclase, biotite and dark green hornblende. Epidote grains and zircon crystals and grains are very abundant. Garnet is also present.

No. 99. Hornblende-Gneiss—Westport, Essex County, New York.

Ref. J. F. Kemp and R. Reudemann. Geology of the Elizabethtown and Port Henry Quadrangles. New York State Museum Bulletin 138. Page 127.

MACROSCOPIC: Dark colored, coarse grained rock with a well marked gneissic structure. It is composed of hornblende and feldspar.

MICROSCOPIC: Granular rock composed principally of hornblende and feldspar. The feldspar is mostly altered to kaolin and sericite but a few grains of nearly clear plagioclase can be seen. There is a small amount of biotite in good crystals. Magnetite is very abundant and pyrite occurs sparingly in small grains. Subhedral crystals of garnet of considerable size contain grains of magnetite. A small amount of chlorite is present.

No. 100. Sillimanite-Garnet-Gneiss—Near Hague, Warren County, New York.

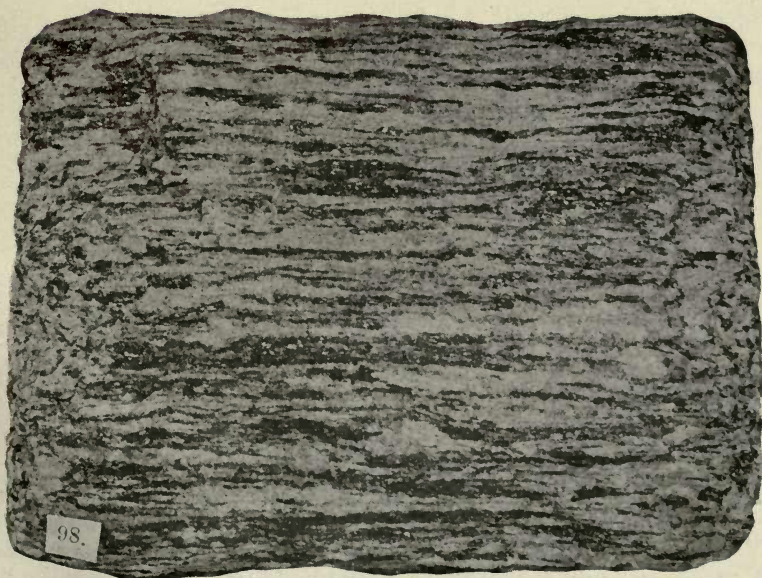
Ref. E. Emmons. Geological Report of the Second District of New York for 1838. Page 170.

MACROSCOPIC: Compact, granular rock with poor gneissic structure. It has a mottled color, pale green and dark red. The red is due to garnet while the green looks like quartz and feldspar.

MICROSCOPIC: The constituents are plagioclase partially altered to sericite, quartz showing undulatory extinction, muscovite, biotite partially altered to chlorite and containing zircon with pleochroic halos. There are also large garnet crystals showing the sieve structure, small grains of pyrite, abundant magnetite with leucoxene coatings and long slender crystals of sillimanite. Chlorite and calcite also occur in patches.



No. 67—Argillaceous Sandstone



No. 98—Biotite-Gneiss

No. 101. Porphyritic Gneiss—Monroe, Connecticut.

Ref. H. E. Gregory. Connecticut State Geological and Natural History Survey Bulletin 6, 1906.

MACROSCOPIC: Light colored, coarse grained, porphyritic rock with parallel structure. The phenocrysts are orthoclase and are sometimes as much as an inch across. Most of them are elongated parallel to the gneissosity. Quartz and biotite constitute the rest of the rock.

MICROSCOPIC: Granular texture. The rock is composed of fresh orthoclase, plagioclase and quartz, some of the grains of which have a slight undulatory extinction. There is also a small amount of micropegmatite and a few instances of grains of orthoclase included in the plagioclase. There are several crystals of apatite and a small amount of zircon and magnetite.

No. 102. Muscovite-Schist—Manhattan Island, New York.

Ref. C. R. Fette. The Manhattan Schist of Southeastern New York State and Its Associated Igneous Rocks. Annals of the New York Academy of Science, Vol. XXIII. 1914.

MACROSCOPIC: Schistose rock composed of biotite, muscovite, quartz and feldspar, also some garnet and pyrite.

MICROSCOPIC: The rock is composed of quartz, plagioclase, muscovite and biotite with pleochroic halos around inclusions of zircon. Pyrite and magnetite are quite abundant. Cyanite crystals, usually twinned, occur in places and garnet crystals may be quite large and have irregular outlines.

No. 103. Garnetiferous Mica-Schist—Southbury, Connecticut.

Ref. H. E. Gregory. Connecticut State Geological and Natural History Survey Bulletin 6, 1906.

MACROSCOPIC: Schistose rock composed of quartz, biotite and muscovite. It contains abundant dodecahedrons of garnet varying in size up to three-eighths of an inch in diameter.

MICROSCOPIC: Laminated texture. It is composed of quartz, a small amount of orthoclase, abundant muscovite and biotite. Large, sharply defined crystals of staurolite and garnet filled with inclusions of other minerals give the sieve structure. There are small grains of zircon and abundant magnetite and pyrrhotite. A small amount of chlorite is present.

No. 104. Graphite Mica-Schist—McDowell County, North Carolina.

Ref. H. B. C. Nitze and H. A. J. Wilkens. Gold Mining in North Carolina and Adjacent South Appalachian Regions. North Carolina Geological Survey Bulletin 10, 1897. Page 18.

MACROSCOPIC: Black, irregularly foliated rock with a shiny luster. There are lentils of granular quartz in the foliated graphite-mica base.

MICROSCOPIC: Greatly contorted texture. The rock is composed of muscovite, graphite and quartz. The graphite is intimately associated with the muscovite and is contorted with it. Shreds of chlorite with a light brownish pleochroism are segregated in places. There are a few crystals of garnet filled with graphite.

No. 105. Tourmaline Mica-Schist—Near Custer, Black Hills, South Dakota.

Ref. Henry Newton. *Geology and Resources of the Black Hills of Dakota*. U. S. Geographical and Geological Survey, 1880. Chapt. III.

MACROSCOPIC: Light colored schistose rock composed of small flakes of white mica and grains of quartz. Abundant black prismatic tourmaline crystals are scattered throughout the rock or gathered into radial clusters.

MICROSCOPIC: The slide is composed of irregular grains of quartz and flakes and scaly aggregates of muscovite. The tourmaline crystals are variously oriented without respect to the schistosity.

No. 106. Hornblende-Schist—Manhattan Island, New York.

Ref. C. R. Fettke. *The Manhattan Schist of Southeastern New York State and Its Associated Igneous Rocks*. *Annals of the New York Academy of Science*, Vol. XXIII. Page 216.

MACROSCOPIC: Fine grained, schistose rock black in color and consisting of acicular hornblende and granular quartz.

MICROSCOPIC: Schistose texture. Hornblende, pleochroic from light brown to deep green, is the principal constituent. A great deal of it is in small elongated crystals and the larger crystals show the sieve structure in that they include numerous grains of the other constituents. Small grains of quartz and plagioclase fill spaces between the hornblende crystals. Large grains of epidote, small grains of titanite, zircon, apatite and magnetite and calcite are quite abundant.

No. 107. Chlorite-Schist—Chester, Vermont.

Ref. C. H. Hitchcock. *Geology of Vermont*. 1861. Vol. I. Page 519. Map in Vol. II.

MACROSCOPIC: Green, foliated rock composed entirely of chlorite.

MICROSCOPIC: The slide is a mixture of chlorite with a gray interference color and greenish biotite which has high interference colors. There is a small amount of clear quartz.

No. 108. Talc-Schist—Warren County, New Jersey.

Ref. F. B. Peck. *Annual Report New Jersey Geological Survey for 1904*, Part III. Page 163.

MACROSCOPIC: Light colored, slaty rock with a soapy feel. It appears to be homogeneously talc.

MICROSCOPIC: The slide is made up of an aggregate of talc and calcite. The talc flakes and shreds have a parallel arrangement causing the schistosity of the rock.

II. Quartzites and Slates:

No. 109. Baraboo Quartzite—Ableman, Wisconsin.

Ref. S. Weidman. The Baraboo Iron-bearing District of Wisconsin. Wisconsin Geological and Natural History Survey Bulletin XIII. Economic Series No. 8, Chapt. IV.

MACROSCOPIC: Fine crystalline, purplish quartz rock.

MICROSCOPIC: The rock consists of rounded or subangular grains of quartz with decided undulatory extinction. There is abundant black metallic hematite between the grains. The siliceous cement is partially granulated and partially in optical continuity with the original grains of quartz.

No. 110. Barron Quartzite—Weyerhauser, Wisconsin.

Ref. W. O. Hotchkiss. Wisconsin Geological Survey Bulletin XLIV. Page 35.

MACROSCOPIC: Pink, clastic rock composed of small rounded quartz grains with a siliceous cement.

MICROSCOPIC: Clastic texture. The rock is composed of rounded quartz grains showing undulatory extinction with a few small grains of magnetite, zircon and rutile. The siliceous cement is deposited in optical continuity with the original grains and is separated from them by a thin film of iron oxide.

No. 111. Quartz-Sericite-Schist—Edgehill, Pennsylvania.

Ref. Florence Bascom. U. S. Geological Survey Atlas Folio No. 162, Page 4. "Chickies Quartzite."

MACROSCOPIC: Thinly laminated rock consisting principally of quartz with a small amount of white mica and a few black specks of metallic mineral.

MICROSCOPIC: Schistose texture with all grains elongated in the direction of the schistosity. Quartz showing undulatory extinction and long shreds of sericite are the most abundant. There are a few large crystals of bluish tourmaline, smaller crystals of zircon, and abundant magnetite in small stringers parallel to the schistosity. It is closely associated with yellowish-brown rutile.

No. 112. Red Roofing Slate—Granville, New York.

Ref. T. N. Dale and Others. Slate in the United States. U. S. Geological Survey Bulletin 586. Page 88.

MACROSCOPIC: Fine, red, fissile rock with a minutely knotted cleavage surface. Small crystals of pyrite are quite abundant.

MICROSCOPIC: The whole slide is greatly obscured by cloudy hematite. It consists of a fine matrix of sericite and quartz with occasional plagioclase and zircon. There are oval patches of chaledonic quartz and rhombs of carbonate throughout the slide. Some chlorite is associated with the sericite. A few small tourmaline prisms and crystals of pyrite may be noted.

No. 113. Gray Roofing Slate—Near Bangor, Pennsylvania.

Ref. R. H. Sanders. Pennsylvania Second Geological Survey Report of Progress. D3, Vol. 1. 1883. Chapt. II.

MACROSCOPIC: Dark gray rock showing good fissility. It is too fine to observe the mineral constituents. It effervesces freely with dilute hydrochloric acid.

MICROSCOPIC: In ordinary light the slide is clouded with fine dust-like particles, which in places are segregated into black nontransparent patches. This is probably graphite. Between crossed nicols there is a background of extremely fine, low birefringent material thickly dotted with small grains of minerals with high interference colors. This is largely calcite and sericite. A few small grains of magnetite are apparent.

No. 114. Green Slate—Pawlet, Vermont.

Ref. T. N. Dale and Others. Slate in the United States. U. S. Geological Survey Bulletin 586. Page 132.

MACROSCOPIC: Very fine grained, greenish-gray slate showing good slaty cleavage.

MICROSCOPIC: The slide is composed of a very fine, confused aggregate of shreds of sericite and grains of quartz, shreds and flakes of chlorite, grains of calcite, stringers and grains of magnetite, small grains of pyrite, abundant rutile and occasional crystals of tourmaline and zircon.

No. 115. Hydromica-Schist—Albemarle County, Virginia.

Ref. T. N. Dale and Others. Slate in the United States. U. S. Geological Survey Bulletin 586. Page 156.

MACROSCOPIC: Black slaty rock with a granular, lustrous cleavage surface. It is composed of quartz grains and small mica flakes. In spots biotite flakes attain a size of three to four millimeters.

MICROSCOPIC: Schistose texture with all the grains elongated in the same direction. The basis of the rock is an aggregate of sericite. With it are flakes of biotite, grains of quartz and zircon and crystals of apatite and tourmaline.

III. Crystalline Limestones and Dolomites:

No. 116. White Marble—Rutland, Vermont.

Ref. T. N. Dale. The Commercial Marbles of Western Vermont. U. S. Geological Survey Bulletin 521.

MACROSCOPIC: White, saccharoidal rock with a few patches of very pale green silicates, probably mica.

MICROSCOPIC: The slide shows only a mosaic of interlocking grains of calcite with a very few extremely small specks of magnetite.

No. 117. Dolomite-Marble—Lee, Massachusetts.

Ref. E. Hitchcock. Final Report on the Geology of Massachusetts, 1841
Page 573.

MACROSCOPIC: Uniformly fine textured, light gray, dolomitic rock.

MICROSCOPIC: The slide consists of a mosaic of dolomite grains showing the lattice twinning with a few flakes of talc.

No. 118. Pink Marble—Near Tate, Georgia.

Ref. S. W. McCallie. A Preliminary Report on the Marbles of Georgia
Georgia Geological Survey Bulletin 1, 1907.

MACROSCOPIC: Schistose rock consisting of alternating bands of granular pink calcite and those in which there is considerable mica.

MICROSCOPIC: The slide consists of a coarse mosaic of calcite showing twin lamination. Many flakes of muscovite are present and also a few small rounded grains of diopside.

No. 119. Dolomite-Marble—Tuckahoe, New York.

Ref. J. D. Dana. On the Geological Relations of the Limestone Belts of Westchester County, New York. American Journal of Science, 3rd Series, Vols. 20, 21 and 22.

MACROSCOPIC: Coarse granular marble composed mainly of dolomite with a few small grains of pyrite and brownish crystals of phlogopite.

MICROSCOPIC: The slide is composed of a mosaic of dolomite grains showing twinning lamellae and some have the crossed twinning bands. Elongated sections of phlogopite are colorless under the microscope. There are a few small pyrite grains.

No. 120. Gray Marble—Gouverneur, New York.

Ref. C. H. Smyth, Jr. A Geological Reconnaissance in the Vicinity of Gouverneur, New York. Transactions of the New York Academy of Science, Vol. 12, 1893. Page 97.

MACROSCOPIC: Coarse grained, bluish-gray rock. Some grains of the calcite are white while others are dark gray. Muscovite, magnetite and a few small crystals of pyrite may be seen.

MICROSCOPIC: The rock is a coarse mosaic of calcite showing lattice twinning. There are also a few crystals of muscovite. Small grains of magnetite are very abundant.

No. 121. Variegated Dolomite-Marble—Swanton, Vermont.

Ref. T. N. Dale. The Commercial Marbles of Western Vermont. U. S. Geological Survey Bulletin 521.

MACROSCOPIC: The rock is composed of blebs of pinkish, fine granular dolomite separated by irregular stringers of dark red ferruginous material.

MICROSCOPIC: Under the microscope the rock exhibits a granular texture of three types in different patches. One type is very fine grained, reddish in color and consists of an aggregate of dolomite with a small amount of fine quartz. It also has a few small grains of magnetite and finely disseminated hematite as a coloring matter. The second type is somewhat coarser and consists of practically clear untwinned dolomite and small grains of quartz. The third type is quite coarse and clear and consists of twinned calcite and large grains of quartz.



No. 105—Tourmaline Mica-Schist



No. 121—Variegated Dolomite-Marble

IV. Ophealcite, Serpentine and Soapstone:

No. 122. Ophealcite—Moriah, New York.

Ref. J. F. Kemp and R. Reudemann. Geology of the Elizabethtown and Port Henry Quadrangles. New York State Museum Bulletin 138. Page 23.

MACROSCOPIC: Light colored, granular rock composed essentially of calcite mottled with green serpentine, fresh diopside, graphite, pyrrhotite and brown mica.

MICROSCOPIC: The slide is granular and consists of calcite and rounded grains of diopside more or less altered to serpentine and showing the mesh texture. Graphite and pyrrhotite are quite abundant. Around the serpentine there is a black metallic mineral resembling magnetite. There are a few flakes of pale brown pleochroic phlogopite.

No. 123. Serpentine—Hoboken, New Jersey.

Ref. J. H. Merrill. U. S. Geological Survey Atlas, Folio No. 83, Page 5.

MACROSCOPIC: Yellowish-green, massive rock with patches and streaks of lighter green color.

MICROSCOPIC: The slide is a mass of fine fibrous serpentine, yellowish to colorless in ordinary light and having low gray interference colors. It has a lattice structure. Small irregular grains of magnetite are very abundant. Small grains of calcite are scattered throughout the rock or arranged in stringers.

No. 124. Verd Antique—Roxbury, Vermont.

Ref. T. N. Dale. The Commercial Marbles of Western Vermont. U. S. Geological Survey Bulletin 521.

MACROSCOPIC: Massive, grayish-green rock with veins of magnesite and fibrous serpentine.

MICROSCOPIC: The rock is a granular aggregate of serpentine with large areas mainly of talc. Magnesite may be disseminated throughout the rock but is usually in veins. Small grains and smears of magnetite occur in the talc areas.

No. 125. Soapstone—Alberene, Albemarle County, Virginia.

Ref. W. B. Rogers. Geology of the Virginias, 1884. Page 296.

MACROSCOPIC: Greenish-gray, foliated rock with a smooth feel and apparently consisting only of talc.

MICROSCOPIC: The rock is a confused scaly aggregate of chlorite and talc. Carbonate grains are quite abundant. The whole slide is peppered with small grains of magnetite.

Index

	Spec.		Spec.
Andesite Breccia	38	Garnetiferous Mica-Schist	103
“ Hornblende	35	Geyserite	92
“ Porphyry, Colo.	37	Gneiss, Biotite-	98
“ Porphyry, Mass.	36	“ Hornblende-	99
Anhydrite	95	“ Porphyritic-	101
Anorthosite	51	“ Sillimanite-Garnet	100
Aporhyolite	7	Granite, Alkali	18
Arkose	65	“ Binary, Colo.	15
Basalt, Hornblende	40	“ “ N. H.	14
“ Porphyry, Olivine	41	“ Biotite- R. I.	16
“ Vesicular	43	“ “ Vt.	17
Bostonite	23	“ Hornblende-	19
Breccia, Andesite	38	“ Pegmatite	20
“ Limestone	57	“ Porphyritic	13
Bronzite	52	Granodiorite	33
Brownstone	64	Graphite Mica-Schist	104
Cancrinite-Syenite, Nephelite	30	Grit, Berea	62
Chert	91	Gypsum	96
Chlorite-Schist	107	Hydromica-Schist	115
Conglomerate, Copper	60	Igneous Rocks	1-56
“ Jasper-	58	Iron Ore, Oolitic	97
“ Quartz-	59	Kimberlite	56
Cortlandtite	55	Leucite-Syenite	28
Dacite, Mica	32	Lherzolite	53
Diabase, amygdaloidal	44	Limestone, Argillaceous	78
“ Mass.	47	“ Birdseye	86
“ N. J.	46	“ Black	87
“ Quartz-	45	“ Breccia	57
Diatomaceous Earth	89	“ Cherty	80
Diorite, Hornblende-	39	“ Coral	75
“ Quartz-, Series	32-34	“ Dolomitic	85
Dolerite Porphyry	42	“ Encrinal	76
Dolomite-Marble, Mass.	117	“ Hydraulic	81
“ “ N. Y.	119	“ Lithographic	79
“ “ variegated	121	“ Oolitic, Ind.	82
“ Siliceous	84	“ “ Pa.	83
Dunite	54	“ Pearly Shell	77
Essexite	31	Marble, Chocolate	88
Felsite (Aporhyolite)	7	“ Dolomite- Mass.	117
“ Porphyry, Quartz- Mass.	8	“ “ N. Y.	119
“ “ Va.	9	“ Gray	120
Flagstone	68	“ Pink	118
Flint	90	“ Variegated Dolomite-	121
Gabbro, Hornblende-	49	“ White	116
“ Hypersthene-(Norite)	50	Metamorphic Rocks	98-125
“ Olivine-Augite-Hypersthene	48		

Index—Continued

	Spec.		Spec.
Mica-Schist, Garnetiferous	103	Rhyolite	6
“ “ Graphite	104	“ Porphyry, S. Dak.	10
“ “ Tourmaline	105	“ “ (Nevadite), Okla. ..	11
Monzonite	26	“ pumiceous	12
“ Porphyry, Quartz	34	Sandstone, Argillaceous	67
Muscovite-Schist	102	“ Arkose	65
Nephelite-Cancrinite-Syenite	30	“ Banded	63
“ Syenite	29	“ Berea Grit	62
Nevadite	11	“ Brownstone	64
Norite	50	“ Glauconitic	74
Novaculite	66	“ Green	74
Obsidian	3	“ Red	61
Oolite, Siliceous	93	Schist, Chlorite-	107
Oolitic Iron Ore	97	“ Hornblende-	106
“ Limestone	82, 83	“ Hydromica-	116
Ophealcite	122	“ Muscovite-	102
Pegmatite	20	“ Quartz-Sericite-	111
Peridotite: Cortlandtite	55	“ Talc-	108
“ Dunite	54	Scoria	1
“ Kimberlite	56	Sedimentary Rocks:	57-97
“ Lherzolite	53	Sericite-Schist, Quartz-	111
Perlite	4	Serpentine	123
Phonolite	27	Shale, Arenaceous	69
Porphyry, Andesite, Colo.	37	“ Calcareous	71
“ “ Mass.	36	“ “ -bituminous	70
“ Basalt-, Olivine	41	“ Carbonaceous	73
“ Dolerite	42	“ Green	72
“ Gneiss	101	Siliceous Oolite	93
“ Granite	13	Slate, Gray Roofing	113
“ Quartz-Felsite, Mass.	8	“ Green	114
“ “ “ Va.	9	“ Red Roofing	112
“ “ Monzonite	34	Soapstone	125
“ Rhyolite, S. Dak.	10	Syenite, Hornblende-	25
“ “ (Nevadite), Okla. ..	11	“ Leucite-	28
“ Trachyte	22	“ Nephelite-	29
Pumice	2	“ “ Cancrinite-	30
Pyroxenite: Bronzite	52	“ Quartz-	24
Quartz-Diabase	45	Talc-Schist	108
“ Diorite Series	32-34	Tourmaline Mica-Schist	105
Quartzite, Baraboo	109	Trachyte Porphyry	22
“ Barron	110	Trachyte, Sanidine-	21
		Travertine	94
		Verde Antique	124
		Vitrophyre	5



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